

Arizona Department Of Administration	Agency STANDARD A800-T4-S10 Rev 0	TITLE: <u>Structured Network Cabling</u> Effective: June 2, 2008
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1. AUTHORITY

- 1.1. The authority for this standard is based on the ADOA Policy A800 – IT Security.
- 1.2. Authority flows from the Standards prepared by the Government Information Technology Agency (GITA) Standard P710-S710, paragraph 4.1 – 4.4.

2. PURPOSE

- 2.1. The purpose of this standard is to establish consistent ADOA/ISD communications wiring installation guidelines for network cabling within the ADOA/ISD data center facilities undergoing new construction and/or major renovations.
- 2.2. This standard recognizes ADOA Information Security's (AIS) use of a Technology Infrastructure and Standards Assessment as the instrument for determining compliance to ADOA and Statewide IT Standards

3. SCOPE

- 3.1. This standard applies to all ADOA departmental business units, including divisions, contractors or other entities using departmental information technology resources and data.
- 3.2. The ADOA Director, in conjunction with the ADOA Chief Information Officer (CIO), is responsible for ensuring the effective implementation of ADOA Information Security Policy and Standards which reference the Statewide Information Technology Policies, Standards and Procedures (PSPs).

4. DEFINITIONS AND ABBREVIATIONS

- 4.1. "CCS" Communications cabling systems
- 4.2. "Contractor" Offeror or Vender or Bidder who has submitted a Proposal in response to the RFP, becomes Contractor upon selection by SPO and signing of the Contract.
- 4.3. "Firestopping" The application of a material, or combination of materials, to retain the integrity of time-related construction by maintaining an effective barrier against the spread of flames, smoke, and gases. It shall be used in specific locations as follows.
 - 4.3.1. Duck, cables, conduit, and piping penetrations through time-rated partitions or firewalls.
 - 4.3.2. Openings and penetrations in time-rated partitions or firewalls containing fire door.
 - 4.3.3. Locations where specifically shown on the drawings or where specified in other sections.

- 4.4. "GITA" State of Arizona Government Information Technology Agency
- 4.5. "Telco" or "Telco Provider" Firm that provides telecommunications services such as telephone and data communications.

5. STANDARD

- 5.1. All communications wiring plans for new construction and major renovations must comply with the requirements outlined in this document. In general, the Contractor shall be responsible for the installation, termination, testing and documentation of all specified communications cable. At completion of the Contractor's testing, the County reserves the right to require the Contractor to perform up to 5% random testing witnessed by Maricopa County Telecommunication Project manager. Additional testing may be required if random testing determines cable specifications are not met.

- 5.1.1. The document is divided into five sections:

General

Testing

- 5.2. The General Section describes standard support requirements and cabling installation procedures, which would apply in any network cabling installation. Sections 2, 3, and 4 are specific to the type of network being installed.

5.3. General Requirements

- 5.3.1. **Environmental Requirements** - Maintain room temperature between 65 degrees Fahrenheit and 75 degrees Fahrenheit with relative humidity range from 30 % to 55% (non-condensing). This should be maintained constantly 24 hours by 7days a week. BTU requirements will be established based on equipment to be installed.

5.3.2. **Power Requirements**

- 5.3.2.1. Data Center Server Floors – A minimum of one dedicated 30A, non-switched 220V AC electrical outlet

- 5.3.3. **Conduit Requirements** – Cable must travel through conduit when run between floors.

- 5.3.3.1. Multiple Telecom rooms interconnected with a minimum of two 4" conduits.

5.3.4. Bonding and Grounding Requirements – The elements defined by the ANSI/TIA/EIA-607 standards are listed below:

TMGB	Telecommunications Main Grounding Bus Bar
TGB	Telecommunications Grounding Bus Bar
TBB	Telecommunications Bonding Backbone
TBB	Telecommunications Bonding Backbone
IBC	Interconnecting Bonding Conductor

5.3.4.1. Telecommunications bonding to electrical ground – The TMGB will be interconnected with the building's service equipment (power) ground using a TBB as large as a No. 3/0 AWG.

5.3.4.2. Telecommunications Main Grounding Bus Bar (TMGB) – Serves as the dedicated extension of the building grounding electrode system for telecommunications infrastructure. The TMGB also serves as the central attachment point for Telecommunications Bonding Backbones. (TBB) and equipment, and MUST be accessible to telecommunications personnel.

5.3.4.3. The TMGB shall:

- 5.3.4.3.1. Be predrilled copper bus bar provided with standard NEMA bolt hole sizing and spacing for the type of conductor to be used.
- 5.3.4.3.2. Be sized in accordance with the immediate requirements of the application and with consideration of future growth.
- 5.3.4.3.3. Have a minimum dimension of ¼ in thick x 4 in wide and variable in length.
- 5.3.4.3.4. Be insulated from its support. A 2" separation is recommended.
- 5.3.4.3.5. The TGB – A bus bar will be placed in each telecommunications room and equipment room and bonded by means of the telecommunications bonding backbone (TBB) conductor to the Telecommunications Main Grounding Bus Bar (TMGB)

5.3.4.4. The TGB shall:

- 5.3.4.4.1. Be predrilled copper bus bar provided with standard NEMA bolt hole sizing and spacing for the type of conductor to be used.

5.3.4.4.2. Be sized in accordance with the immediate requirements of the application and with consideration of future growth.

5.3.4.4.3. Have a minimum dimension of ¼ in thick x 4 in wide and variable in length.

5.3.4.4.4. Be insulated from its support. A 2" separation is recommended.

5.3.4.5. The TBBIBC is a conductor that interconnects the telecommunications bonding backbones. Whenever two or more vertical TBBs are used within a multistory building, the TBBs shall be bonded together with a TBB interconnecting bonding conductor (TBBIBC) at the top floor and at a minimum of every third floor in between.

5.3.5. As-Built Drawings.

5.3.5.1. It is required that the Contractor's lead technician return to AIS, all floor plans or drawings after completion of installation projects showing the following information at minimal.

5.3.5.2. Cable routing

5.3.5.3. Office drop locations with drop numbers per labeling standard. (See labeling in the document)

5.3.5.4. Location of vertical conduits or between floor vertical accesses.

5.3.5.5. Location and size of horizontal conduits, junction boxes if home run conduits are used for containment of network cabling.

5.3.5.6. Any additional information specific to installation.

5.3.6. Codes and Regulations All the work specified herein shall be in direct accordance with the following codes and regulations.

5.3.6.1. Federal Communications Commission (FCC):

5.3.6.1.1. Title 47, Code of Federal regulations, part 68

5.3.6.1.2. Docket 88-57

5.3.6.2. Local Codes and regulations:

5.3.6.2.1. City/County

5.3.6.2.2. State of Arizona

5.3.6.3. National Electrical Code (NEC):

5.3.6.3.1. Article 250: Grounding

5.3.6.3.2. Article 770: Optical Fiber Cable

5.3.6.3.3. Article 800: Communications Circuits

5.3.7. **Standards.** All work specified herein shall meet or exceed all requirements set forth in the following standards:

5.3.7.1. GITA Guidance Documents

5.3.7.1.1. Enterprise Architecture Domain Documents

5.3.7.1.2. Policies, Standards and Recommended Practices

5.3.7.2. American National Standards Institute (ANSI):

5.3.7.2.1. C.8.47-1977: Polyolefin Insulated Thermoplastic Jacketed Communication Cables

5.3.7.2.2. ANSI/NFPA 70: National Electric Code

5.3.7.3. Electronic Industries Association (EIA):

5.3.7.3.1. RS-354: Standard Colors for identification and coding

5.3.7.3.2. RS-455: Standard Test Procedure for Fiber Optic Communication Cables

5.3.7.3.3. EIA/TIA-310: Racks, Panels, and Associated Equipment

5.3.7.3.4. EIA/TIA-464: PBX Switching Equipment for Voiceband Applications

5.3.7.3.5. EIA/TIA-568/568B: with current draft addendum at time of purchase, Specifications for Category 5e 1.4.3.3.6a

5.3.7.3.6. EIA/TIA-568/568B: with current draft addendum at time of purchase, Specifications for Category 6

5.3.7.3.7. EIA/TIA-569: Commercial Building Standard for Telecommunication Pathways and Spaces

5.3.7.3.8. EIA/TIA-606: Administrative Standard for the Telecommunications Infrastructure of commercial Buildings

5.3.7.3.9. EIA/TIA-607: Commercial Building Grounding and Bonding Requirements for Telecommunications

5.3.7.3.10. EIA/TIA-TSB-36: Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted Pair Cables

5.3.7.3.11. EIA/TIA-TSB-40: Technical Systems Bulletin, Additional, Transmission Specifications for UDP Connecting Hardware

5.3.7.3.12. EIA/TIA-TR-67: Latest Draft Revision

5.3.7.3.13. PN-3012: Fiber Optic Premises Cable Guide (Latest Draft)

5.3.7.4. National Electronic Manufacturer's Association (NEMA):

5.3.7.4.1. TC 9-1983: Smooth wall Coilable Polyethylene Electrical Plastic Conduit

5.3.7.4.2. VE 1-1991: Metallic Cable Tray Systems

5.3.7.5. Institute of Electrical and Electronics Engineers (IEEE):

5.3.7.5.1. 802.3i Carrier Sense Multiple Access with Collision Detection (10/100/1000Base –T Wiring Plant)

5.3.7.5.2. 802.5b/D10 Token Ring Access Method (Token Ring Wiring Plant)

5.3.7.6.National Electrical testing Association. Inc. (NETA):

5.3.7.6.1. Standard testing specifications

5.3.7.7.Underwriters Laboratories, Inc. (UL)

All materials furnished, for which Underwriters Laboratories, inc. standards have been established, shall be listed and bear the:

5.3.7.7.1. UL label or the listing label of an equivalent independent test laboratory

5.3.7.7.2. UL 94 V-0 Burn Characteristics

5.3.7.7.3. UL 444: Standard for Safety, Communication Cables

5.3.7.7.4. UL 497: Standard for Safety, Protectors for Communication Circuits

5.3.7.7.5. UL 497A: Standard for Safety, Secondary Protectors for Communication Circuits

5.3.7.7.6. UL 497B: Standard for Safety, Protectors for Data Communications and Fire Alarm Circuits

5.3.7.7.7. UL 969: Standard for Safety, and Labeling Systems

5.3.7.7.8. UL 1459: Standard for Safety, Telephone Equipment

5.3.7.7.9. UL 1863: Standard for Safety, Communications Circuit Accessories

5.3.7.8.Occupational Safety and Health Administration (OSHA)

5.3.7.8.1. Latest edition with all amendments in effect as of the date of this inspection

5.3.7.9.American Society for Testing and Materials (ASTM)

5.3.7.9.1. Designations and standard testing specifications

5.3.7.9.2. Firestopping

5.3.7.9.2.1.ASTM E 814 Fire Tests of Through-Penetration Firestops

5.3.7.9.2.2.UL Building Materials Directory

5.3.7.9.2.2.1. Through-Penetration Firestops Systems

5.3.7.9.2.2.2. Fill, Void or Cavity Materials

5.3.7.9.2.3.Applicable construction Code

5.3.7.9.2.4.NFPA 101 – Life Safety code

5.3.7.9.2.5.NFPA 70 – National Electrical Code

5.3.8. Fire-Stop Requirements

5.3.8.1.General: Local code-approved fire-stop means shall be applied at each interface between floors and between all fire-rated spaces

5.3.8.2.Cable tray/Ladder Penetrations: Putty type firestop material shall be used for cable tray/ladder penetrations

5.3.8.3.Wall and Floor Penetrations: Putty/sleeve type firestop shall be used for wall and floor penetrations

- 5.3.8.4. Inspection requirements: All necessary shop drawings, showing firestop means and materials, shall be developed by contractor as required by site inspection officials

5.4. Horizontal Cabling

5.4.1. Category 6:

- 5.4.1.1. The distance from the switch device to the network interface connection at the workstation shall not exceed 300 cable feet when using Category 6 cabling. The maximum not to exceed includes all patch cables, line cords and any other cabling between the workstation and hub.
- 5.4.1.2. The switch to switch maximum distance shall not exceed 300 cable feet when using Category 6 cabling including any patch or line cords.
- 5.4.1.3. The Category 6 cable shall not exceed the specifications for the specific topology being installed and shall not exceed 300 feet from switch to workstation.
- 5.4.1.4. All terminations will follow Category 6 specifications and be Category 6 compliant.
- 5.4.1.5. Cable bend radius will not exceed 8 times the cable diameter.
- 5.4.1.6. The cable run shall have no splices.
- 5.4.1.7. The cables will not be “cinched” with tie-raps or any other device used to support the cables in the overhead ceiling space.
- 5.4.1.8. Cable will not be run in bundles greater than 120 cables, due to the “crushing” effect from the weight of the cables.

5.4.2. Cable Routing

- 5.4.2.1. Route cabling so that a minimum distance of 12" is maintained between any network cabling and florescent lighting fixtures. Under no circumstances shall network cables be installed physically touching florescent lighting fixtures.
- 5.4.2.2. Avoid routing network cabling near sources of high electromagnetic radiation, electrostatic discharge, or radiated frequency interference. Devices such as electric motors or RF generating equipment may generate electrical emissions as described. When in doubt, check with the manufacturer of the equipment. The network may appear to

function normally but problems will occur as size and network traffic increases.

5.4.2.3. Cables installed in removable tile suspended ceiling areas shall not rest on ceiling grids.

5.4.2.4. Horizontally installed cables in removable tile suspended ceiling areas will be supported by **cable tray** for main cable runs and j hooks for independent cable drop locations. Use tie wraps that have a minimum tensile unlocking strength of 50 pounds or more. Space supports at intervals of 5 feet or less. If tie-wrapping method is used, attach cable bundles only to hangers permanently affixed to the underside of the floor above. Cable bundles may be attached to existing ceiling grid support wires provided the cable bundles do not exceed a combined per foot weight of 0.5 lb per foot.

5.4.2.5. Cable may be installed using roof trusses as supports. Tie wrap at each truss to minimize sagging.

5.4.2.6. Existing pipes carrying liquids, gases, electrical conduits or existing cabling, will not support horizontal cables.

5.4.2.7. Horizontally installed cables running parallel to electrical conduits shall not be tie wrapped to the conduits. Additionally, the network cable bundles shall be separated by a minimum of 3" of free air space from electrical conduits.

5.4.2.8. Cable segments shall not exceed the manufacturer specifications for pulling tension or bend radius. Cable segments shall not be stretched, crimped or compressed during installation.

5.4.2.9. All horizontal or vertically installed cable penetrating fire walls or floor levels shall be sealed using an approved fire stop compound and installed in compliance with local building codes.

5.4.2.10. All network cabling shall be installed in straight runs parallel to building lines. When changing direction of a cable run, make smooth 90 degree turns without kinking or damaging the cable outer jacket or conductors. Adhere to the cable manufacturers minimum bend radius when making turns.

5.4.2.11. Cables that have a common source and destination shall be bundled together with Velcro every 2 feet.

5.4.3. Rack Termination

5.4.3.1.All cable entering racks must enter from the top.

5.4.3.2.Network cabling should be supported by ladder tray. Copper riser cabling should be supported by D-Rings.

5.4.3.3.All blocks and patch panels should be mounted square and level.

5.4.3.4.The following colored labels will be used to identify cable termination types with in the telecommunications room.

Red	SCIFI Customers
Blue	ADOA Servers
Yellow	Auxiliary circuits, alarms, security

5.4.4. Labeling

5.4.4.1.All cables will be labeled approximately 6" from the jack.

5.4.4.2.All cables shall be labeled at termination points. The format of the identifying number is as follows:

- 5.4.4.2.1. Source (S)
 - 5.4.4.2.1.1.Row (1-46)
 - 5.4.4.2.1.2.Column (A-AY)
 - 5.4.4.2.1.3.Device (A,B,C...)
 - 5.4.4.2.1.4.Port (Module/Port)
- 5.4.4.2.2. Destination (D)
 - 5.4.4.2.2.1.Row (1-46)
 - 5.4.4.2.2.2.Column (A-AY)
 - 5.4.4.2.2.3.Device (A,B,C...)
 - 5.4.4.2.2.4.Port (Module/Port)

Example:

S:32 AA A 0/42 D:32 Z 22 A

5.4.5. Vertical Cabling

5.4.5.1.Proper grounding as described in grounding section will be adhered to for all copper backbone cabling.

5.4.5.2.Fiber will be terminated into a Rack mounted LIU.

5.4.5.3.All fiber optic cable will be installed in a protective inner duct. A plenum rating must be met if the inner duct is to be installed in a plenum ceiling. Check local building codes for verification.

5.4.6. Testing

5.4.6.1. All Category 6 cables will be tested to Category 6 specifications, a tester designed to test for: Pair mapping, Attenuation, Near end cross-talk, Far end cross-talk, Attenuation to Cross-talk Ratio (ACR), and Distance should be used and printed test results should be placed in the job folder. This should include patch panels, and patch cords to the switch port. Print outs from the tester or electronic file shall be used to verify the Category 6 testing. The test result print outs shall be turned into the AIS at final acceptance of the completed project along with As Built Drawings and other required documentation.

5.4.6.2. All fiber optic cable strands shall be tested using a Calibrated fiber tester prior to installation to ensure all strands are continuous and match published specifications. If Calibration is required for the tester. Verification must be provided upon request.

5.4.6.3. All terminated single mode fiber optic cable strands shall be tested using calibrated fiber tester approved by AIS. The maximum db loss per strand is as follows:

ST Connectors .02db
SC Connectors .02db

5.4.6.4. All terminated multi mode fiber optic cable strands shall be tested using calibrated fiber tester approved by AIS. The maximum db loss per strand is as follows:

ST Connectors .03db
SC Connectors .03db

5.4.6.5. Defective strands revealed in the testing procedure will be repaired prior to final acceptance of the completed project.

5.4.6.6. Print outs from the fiber tester, electronic file or test results on CD shall be used to verify the fiber optic testing. The test result will be turned into AIS at final acceptance of the completed project along with As Built Drawings and other required documentation.

6. STANDARD NON-COMPLIANCE

6.1.

7. REFERENCES

7.1.

8. ATTACHMENTS